

ARENES

1. In this question, one mark is available for the quality of spelling, punctuation and grammar.

Describe with the aid of suitable diagrams the bonding and structure of a benzene molecule.

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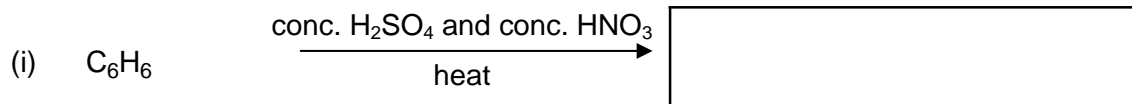
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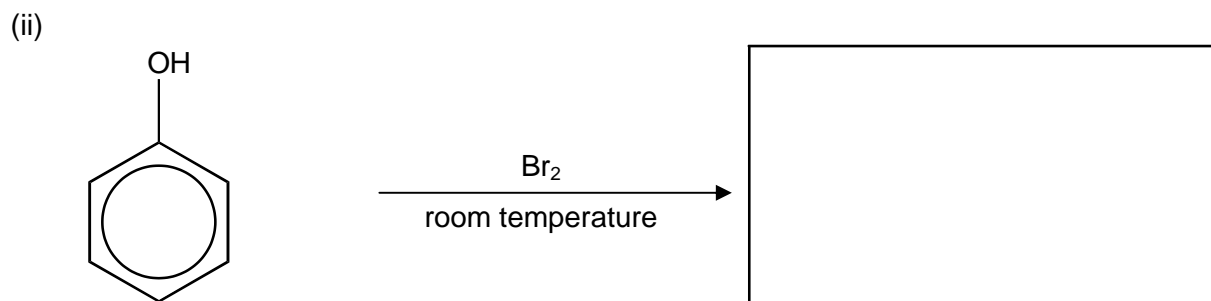
Quality of Written Communication [1]

[Total 7 marks]

2. Complete the reactions by drawing structural formulae in each of the boxes provided.



[1]



[1]

[Total 2 marks]

3. (a) In this question, one mark is available for the quality of use and organisation of technical terms.

Bromine is used in organic chemistry to carry out a variety of electrophilic reactions.

- (i) Describe and explain how a molecule of bromine acts as an electrophile. Illustrate your answer with a diagram showing relevant dipoles and curly arrows.
- (ii) Use your answer to (i) to explain why bromine reacts much more readily with cyclohexene than it does with benzene.

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Quality of Written Communication [1]

(b) The compound iodine monobromide, IBr, also reacts with benzene in an electrophilic reaction.

(i) Which compound would be the main product of this reaction, iodobenzene or bromobenzene? Explain your answer.

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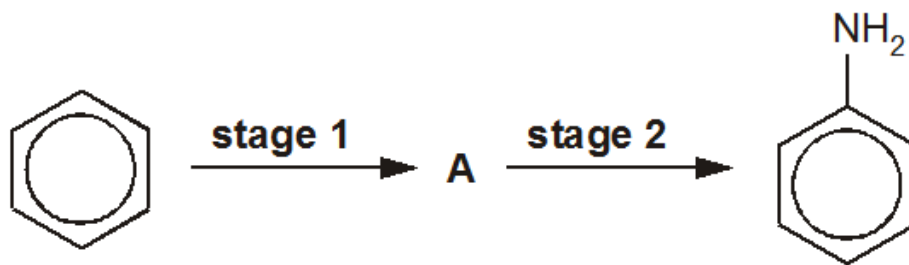
(ii) Deduce an equation for the reaction of iodine monobromide with benzene.

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[Total 11 marks]

4. In this question, one mark is available for the quality of use and organisation of scientific terms.

Phenylamine can be manufactured from benzene in two stages.



Describe how benzene could be converted by these two stages into phenylamine.

Include the structure of the intermediate compound **A**. State the reagents and conditions. Give a balanced equation for each stage.

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Quality of Written Communication [1]

[Total 8 marks]

5. A chemist was investigating the reactions of benzene, phenol and cyclohexene with bromine. She found that they all reacted with bromine but under different conditions.

- (a) The chemist found that when benzene reacts with bromine, a halogen carrier is required as a catalyst.

Write an equation for this reaction.

You do **not** need to show the halogen carrier in your equation.

[1]

- (b) The chemist also found that when phenol or cyclohexene reacts with bromine, a halogen carrier is **not** required.

- (i) The chemist observed that bromine decolourises when it reacts with phenol.

What other observation would she have made?

Draw the structure of the organic product formed.

Observation

Organic product:

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- (ii) Cyclohexene also decolourises bromine.

Name the organic product formed.

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- (iii) Explain the relative resistance to bromination of benzene compared to phenol and compared to cyclohexene.



In your answer, you should use appropriate technical terms, spelt correctly.

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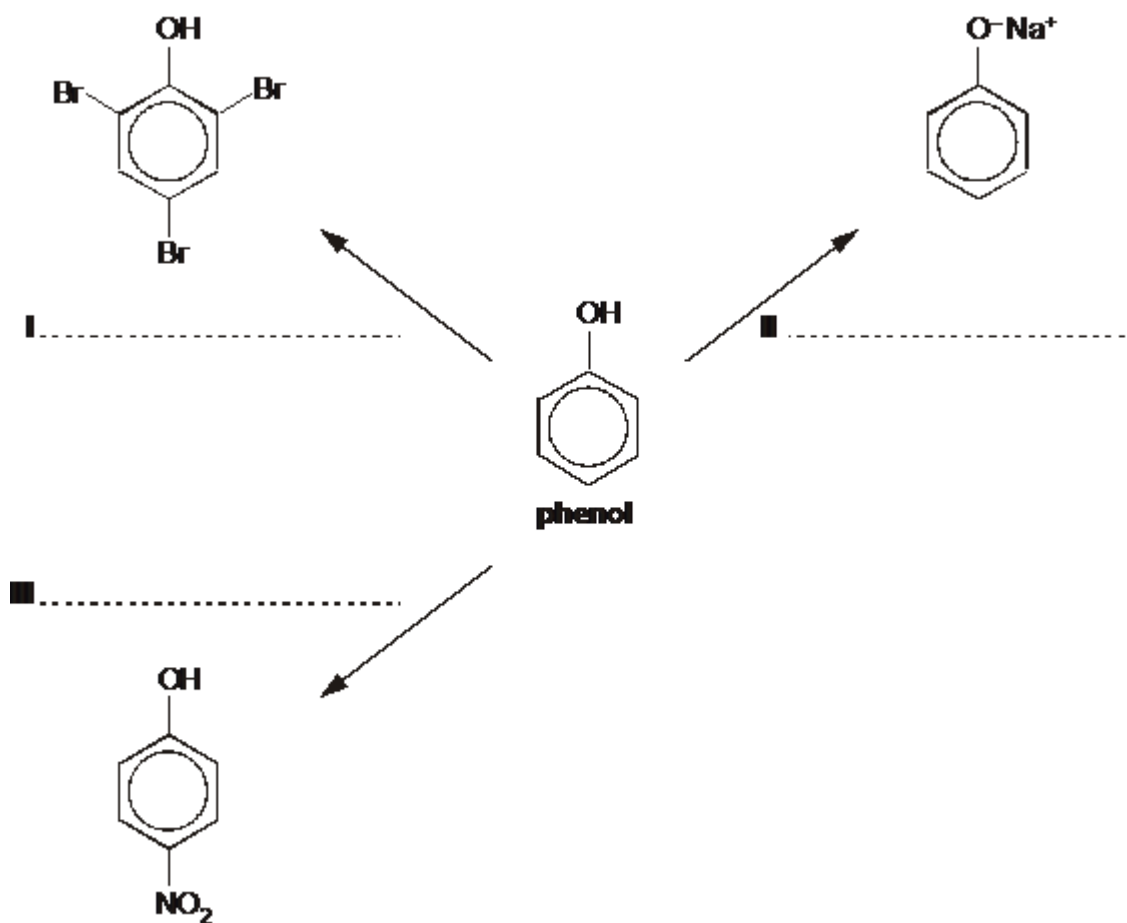
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[Total 9 marks]

6. The diagram below shows some reactions of phenol.



On the diagram above, identify suitable reagents that could be used to carry out reactions I, II and III.

[Total 3 marks]